ence. Hence so far as the paucity of data in 1873 enabled any judgment to be formed, the preference appeared to belong to the revolution in 6·977 years. On this supposition there would be a very near approach to the orbit of Jupiter near the ascending node, which would render possible an amount of perturbation at some past time, that might have fixed the comet in an orbit of such limited dimensions.

If the comet were really revolving in an elliptical orbit with this period of revolution, neglecting perturbations, which might however be sensible since 1873, it would be again due at perihelion about November 24 in the present year, in which case its track in the heavens would not be very different from that followed in 1873. We are not aware if any search has been made for the comet. It would have been possible to have decided in 1873 if a short period were admissible could observations have been obtained in the southern hemisphere: this was not done, and the identity of the comets of 1818 and 1873 remains therefore open to conjecture; but it must be borne in mind that the data in the former year are in a high degree uncertain.

PECHÜLE'S COMET.—Elements computed by the discoverer from observations at Copenhagen on December 16, 17, and 20, have a general resemblance to those of the comet of 1807, so elaborately discussed by Bessel, but after his resulting period of many centuries, and considering the position of the orbit in the system, there can be of course no question of identity of these bodies. At Greenwich noon on January 1 the comet's position will be, by Pechüle's elements, in R.A. 20h. 1·9m., N.P.D. 70° 24′, and on January 5 in R.A. 20h. 19·6m., N.P.D. 68° 30′.

CHEMICAL NOTES

MM. HAUTEFEUILLE AND CHAPPUIS, in continuing their investigation of the conditions under which oxygen is transformed into ozone, have shown in *Compt. rend.* that the character of the electric discharge to which the oxygen is subjected largely influences the quantity of ozone produced. If the discharge assume the character of a luminous shower the maximum amount of ozone is produced, the temperature of such a discharge being lower than that of the ordinary *effluve.* The production of this special form of discharge is ensured by mixing with the oxygen a small quantity of a foreign gas whose physical properties are dissimilar from those of oxygen; of the gases experimented with silicon fluoride has given the best results. If nitrogen be the foreign gas the transformation into ozone is greater than when pure oxygen is employed, but the discharge is not altogether luminous. Hydrogen is more effective than nitrogen. The presence of carbon dioxide also insures a large amount of ozonation. In their earlier experiments on the liquefaction of ozone the authors only succeeded in obtaining a mist in the Cailletet tube when the pressure was suddenly withdrawn. They now find that if a mixture of carbon dioxide and oxygen which has been ozonised at a low temperature be submitted to the action of the silent discharge at − 23°, and be slightly compressed, the gas acquires a deep blue colour, and after a time a blue liquid is produced. At − 88° the liquid is very dark blue. When carbon dioxide is decomposed by the electric spark at − 23° a blue gas is produced, and at a certain pressure (exact pressure is not mentioned) the undecomposed carbon dioxide condenses to a blue coloured liquid. By this experiment the authors think they have proved that ozone is one of the products of the decomposition, by the spark, of carbon dioxide.

THE heat of formation of benzene has recently been measured by Thomsen (*Berliner Berichte*) and by Berthelot (*Compt. rend.*). The results show considerable differences: but from the accounts of the experiments, Thomsen's number seems the more trustworthy. For the heat of combustion of gaseous benzene Thomsen finds the number 805,800 heat units; Berthelot the number 776,000. For the heat of formation of gaseous benzene, at constant volume, from amorphous carbon and hydrogen, Thomsen finds −20,120 heat units; Berthelot, on the other hand, finds + 5800. Berthelot does not state whether this number is calculated for constant volume or constant pressure. Thomsen makes certain theoretical deductions from the value which he has found for the heat of formation of benzene, basing these on his calculations for the heat of formation of "singly- and doubly-linked" carbon atoms (see NATURE, vol. xxii. p. 608): he concludes that the generally accepted hexagon formula for benzene is probably incorrect, and that a formula in which each carbon atom is "singly linked" to three others is to be preferred.

BERTHELOT finds the heat of formation of gaseous dipropargyl—C_6H_6—a metamer of benzene—from amorphous carbon to be −64,800 heat units. The instability and easy polymerisation of this body are explained by the great absorption of heat which occurs in its formation. Attempts to transform dipropargyl into benzene were unsuccessful. Berthelot has also determined the heats of formation of various hydrocarbons, and finds certain constant differences between the successive members of homologous series.

HERR V. MEYER describes in the *Berliner Berichte* a very elegant modification of his method of determining vapour densities, whereby the specific gravities of permanent gases may be readily measured at very high temperatures. At the highest temperature of a Schlösing's furnace (about 1400°) the density of hydrogen vapour was normal. It has now been shown that the coefficients of expansion of the following gases are not changed at very high temperatures: tellurium, sulphur, nitrogen, oxygen, hydrogen, mercury, carbon dioxide, hydrochloric acid, arsenious oxide.

THE following numbers for the vapour densities of tellurium and selenium have been recently obtained by Deville and Troost (*Compt. rend.*):—Selenium at 1420° = 5·68 (calculated = 5·54), tellurium at 1440° = 9·0, at 1390° = 9·08 (calculated = 8·93).

IN the *Wien. Acad. Berichte* Herr Offer describes the results of experiments which he thinks show that Guthrie's cryohydrates are merely mixtures of various salts and ice: alcohol dissolves the ice, leaving a "skeleton" of undissolved salt; cold water dissolves the salt, and leaves the ice with the form of the cryohydrate. Solution of a cryohydrate is attended with the same thermal change as solution of the salt and ice separately.

THE connection which exists between the opium and cinchona alkaloïds, and between both of these groups of compounds and pyridine, has been recently made more apparent by the work of Herr E. v. Gerichten (*Berliner Berichte*), who has shown that the so-called apophyllenic acid—obtained by oxidising the opium alkaloïd cotarnine—is really the acid methyl salt of pyridine dicarboxylic acid, which acid is obtained from the cinchona alkaloïd cinchonine, and which when heated with lime yields pyridine.

WHEN an aqueous solution of potassium, sodium, or lithium chloride, or potassium nitrate is kept for some time in a vertical tube, the upper part of which is maintained at a considerably higher temperature than the lower part, diffusion of the salt from the hotter to the colder part occurs, according to M. C. Soret (*Naturforscher*) The amount of diffusion in a given time depends upon the original concentration of the solution, and is also connected with the molecular weight of the salt used.

M. DUFET stated some little time since that the refractive index of a mixture of isomorphous salts in solution is equal to the mean of the indices of the components. Herr Fock (in *Zeitschrift für Crystallographie*) concludes, from measurements of the refractive indices of solutions of thallium and potassium alums, of lead and strontium thiosulphate, and of magnesium chromate and sulphate, that Dufet's statement does not hold good in all cases: for the second pair of salts mentioned above it is approximately correct. In *Compt. rend.* Dufet gives numbers showing that his statement applies to a mixture of magnesium and zinc sulphates.

In *Compt. rend.* M. Demarcay describes two new compounds containing sulphur, nitrogen, and chlorine, viz., SNCl and $(SN)_3Cl$: the former prepared by passing chlorine into a solution of nitrogen sulphide in chloroform, and the latter by adding nitrogen sulphide to a solution, in chloroform, of the compound SNCl. SNCl is partly decomposed by heat, in accordance with the equation $2SNCl = N_2 + S_2Cl_2$.

THE relation between the tôtal energy developed in the chemical reactions which occur in various kinds of galvanic batteries and the energy which appears in the form of current electricity, has been recently studied by Thomsen (*Wiedemann's Annalen*) using a thermal method of measuring the total energy. He finds that the whole of the energy developed in the chemical change appears as electric energy in Daniell's battery (with closed circuit), and in those forms of batteries in which the metallic surface of the negative electrode is not changed by the electrolytic process; when nitric acid is used as electrolyte the same total conversion of one into another form of energy is

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nearly realised, but the gradual absorption, by the liquid, of reduction products, tends to cause a deviation from this result.

BERTHELOT has recently studied (*Compt. rend.*) the action of air and of hydrochloric acid in presence of air, on pure mercury. He confirms the generally accepted fact that pure mercury is very slowly and superficially oxidised by the action of air at ordinary temperatures. If gaseous hydrochloric acid is shaken with mercury in presence of air mercurous chloride and water are produced. This reaction ($Hg_2 + 2HCl + O = Hg_2Cl_2 + H_2O$) is attended with the evolution of 53,400 thermal units, whereas the oxidation of mercury ($Hg + O = HgO$) is attended with the evolution of only 21,100 units. The action of hydrochloric acid in presence of air on copper ($Cu_2 + 2HCl + O = Cu_2Cl_2 + H_2O$) is accompanied by the evolution of 26,500 thermal units, hydrochloric acid in absence of air is, as is well known, almost without action on metallic copper.

IN the course of his investigation into the action of phosphorus on hydriodic acid, Damoiseau (*Compt. rend.*) describes a method for preparing phosphonium iodide in a state sufficiently pure for general use. Ten parts ordinary phosphorus in small pieces are allowed to react for some time on twenty-two parts of an aqueous solution of hydriodic acid (saturated in the cold); two parts iodine are added, and the phosphorous acid which is produced is separated from the crystals of phosphonium iodide by washing with aqueous hydriodic acid.

A SERIES of compounds, derived from monohydric alcohols, in which the "hydroxylic hydrogen" of the alcohol is replaced by aluminium, is described (*Chem. News*) by Gladstone and Tribe. These bodies are prepared by the action of aluminium in presence of aluminium iodide on the alcohol. The new substances are solids, melting to clear liquids which do not solidify at temperatures much below the melting points of the solids; they are decomposed by water with formation of aluminium hydrate and the corresponding alcohol.

THE sulphides of vanadium have been investigated by Kay (*Chem. Soc. Journ.*). The compounds obtained by Berzelius by the action of sulphuretted hydrogen on solutions of vanadium salts are shown to contain oxygen in addition to vanadium and sulphur, but no definite formula can be assigned to any of these bodies. Vanadium trisulphide V_2S_3 is obtained by the action of dry sulphuretted hydrogen on heated vanadium trioxide, as described by Berzelius. When this compound is heated to bright redness in hydrogen, it is reduced to the disulphide V_2S_2, and when heated with sulphur to 400° it is converted into the pentasulphide V_2S_5.

IN the *Chem. Soc. Journ.* Kingzett describes experiments on the atmospheric oxidation of phosphorus which seem to prove that ozone and hydrogen peroxide are simultaneously produced when air is drawn over phosphorus partially immersed in water.

MANY so-called basic sulphates of iron have been from time to time described: of the fifteen which are generally recognised as probably existing it would appear from Pickering's experiments (*Chem. Soc. Journ.*) that only one, viz. $2Fe_2O_3 . SO_3$, actually exists.

DR. SYDNEY MARSDEN has recently experimented on the action of boron on various metals at high temperatures. He finds (*Proc.* R. S. Edin. and *Chem. Soc. Journ.*) that silver dissolves amorphous boron, and that on cooling, pure boron is obtained partly in the graphitoidal, partly in the adamantine form. Copper combines with boron to form the compound B_2Cu_3.

PROF. BELLATI has published in pamphlet form, under the title "Proprieta termiche notevoli di alcuni Ioduri doppi," an extended and careful series of observations of the specific gravities, specific heats, thermal expansions, and thermal changes which accompany changes of colour and structure, of several double iodides of mercury, more especially of the three salts $HgI_2 . 2AgI$, $HgI_2 . 3AgI$, and $HgI_2 . Cu_2I_2$.

HERR HAASS describes in the *Berliner Berichte* a simple method of illustrating the existence of the so-called "critical pressure" described in this journal by Carnelley. A small piece of mercuric chloride is placed in a glass tube which is closed at one end, and communicates at the other with a Bunsen pump. So long as the manometer registers less than about 400 mm. pressure it is not possible to melt the mercuric chloride by heating it; the salt passes at once from the solid to the gaseous state. But immediately the pressure rises above about 420 mm. the mercuric chloride melts.

IN studying the condensation products of aldehyde Prof. Lieben has obtained (*Wied. Akad. Ber.*) a new alcohol belonging to the same series as glycerin, viz. $C_4H_7(OH)_3$. The new compound, called butenyl glycerin by Lieben, is a syrupy, sweet-tasting liquid, soluble in water, boiling at 172°–175° under a pressure of 27 mm. It forms a triacetin analogous in properties to the natural fats; when heated with oxalic acid its behaviour is similar to that of glycerin: formic acid is produced along with an oily, strongly-smelling substance which has not as yet been fully examined.

PHYSICAL NOTES

MONS. A. ANGOT proposes a new formula for calculating altitudes from barometric observations, based upon that given originally by Laplace. The existing method of calculation from observed monthly or annual means is found, as Plantamour has shown, to be defective, since its results exhibit an uncertainty that varies with the season, an elevated station appearing to be higher by day and in summer than at night or in winter. As an example, when the height of the Great St. Bernard is measured by comparison of barometer observations between that place and Geneva, it would appear that the height of the Great St. Bernard exhibits a diurnal variation of 17 metres in winter and of more than 47 metres in summer; while the mean of the June observations gives a height of 25 metres higher than that found from the January numbers! These anomalies M. Angot explains by the facts that the mean temperature between the stations is not exactly equal to the half sum of the two temperatures, and that the weight of the air between the two stations is on the other hand greater when the mean temperature is low. The rather complicated formula proposed by M. Angot gives the difference in altitude by calculating directly the height of each station above an imaginary plane at which the barometric pressure is equal to 760 millims. No empirical coefficients are needed in this case, the standard constants of Regnault and others for air and aqueous vapour being taken. M. Angot has recalculated from his formula a new set of tables, involving all the corrections that must be applied to the older tables of the Bureau des Longitudes.

IN a recent number of the *Journal de Genève* M. Colladon has pointed out that a poplar or other tall tree may, if its roots strike into damp soil, serve as a lightning-conductor to protect a house; and he thinks he has verified this conjecture by examination of a number of individual cases of lightning-stroke. In the case however where the house stands between the tree and a piece of water, a pond or a stream, the shortest path for the lightning from the tree to the wet conductor may be through the house!

YVON ZOCH has described a new kind of electric dust-figures, which he regards as having an important bearing upon the theory of discharges in vacua, being in opposition to the views of Crookes. Tubes of 1 to 3 centims. diameter, and from 10 to 30 centims. in length, were closed at both ends by corks pierced to receive copper wires. In the tubes were placed various powders, bronze powder being chiefly used in preference to others, which being lighter adhered to the sides of the tube. One wire was then connected with the positive conductor of an electric machine; from the other the repelled electricity dissipated itself into the air. In other cases the discharges of Leyden jars were employed. The experiments were all conducted at atmospheric pressure. When thus treated the bronze powder arranged itself in beautifully-marked ridges or strata, varying in regularity according to the original distribution of the powder. A space free from all traces of powder was observed to surround the positive pole. Uusually there was a corresponding accumulation about the negative pole. These ridges or striations may be compared to the stratifications observable in Geissler-tubes; and Herr Zoch shows that variations in the strength of the electric discharges, in the width of the tubes, &c., produce upon these figures similar effects to those they produce on the luminous striæ of vacuous tubes. In this present case a mechanical repulsion of the particles lying near the poles undoubtedly takes place; and the author of this research believes that the presence of light at the poles of the Geissler tube may be similarly accounted for on the hypothesis that the luminous regions are those of less density than the non-luminous. Since the bronze powder is heaped up mostly about the negative pole the inference is that at the negative pole of a Geissler tube the residual gas has a greater density than at

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